COURSE OUTLINE

1. **COURSE TITLE:** Network Cable Technology

2. **CBEDS TITLE:** Telecommunications

3. **CBEDS NUMBER:** 4618

4. **TITLES:** PC Network Technician
   Communications Technician – DOT 828.261-022
   Entry level Network Cabling Specialist

5. **COURSE DESCRIPTION:** This is an Open Entry-Open Exit introductory course to the Physical layer of Networking. The program instruction involves 3 Tiers. In Tier 1, students are familiarized with the history and development of the Telecommunications Industry. Tier 1 objectives include basic terminology, function, purpose and simple troubleshooting devices. Tier 2, students will gain knowledge and skills for entry level technicians in the network cabling industry. Focus will be on the use of industry tools, cable construction techniques, troubleshooting, and repairs. Industry standards will be addressed for a variety of cables including TWISTED PAIR, UNSHIELDED TWISTED PAIR, SHIELDED TWISTED PAIR, 66/100 terminal blocks, coaxial, BNC, RG and modular jacks. Tier 3 centers on Fiber Optic telecommunication devices and instruction will include the basics of light and light transmission through fiber optic cables. Instruction will also include cable construction, techniques of splices, closures, patch cords, cabinets and couplers found in fiber optic systems.

   In cooperation with C-Tech Associates, certification as "Network Cabling Specialist" will be earned upon completion of Tier 2 "Copper-Based systems" and Tier 3 "Fiber Optics". Certification is based on construction and troubleshooting techniques and a written final exam using a weighted score method. Certification is issued if the weighted score is 85% or better.

6. **HOURS:** **180**

7. **PREREQUISITES:** No pre-requisite is required if students enter at Tier 1. Tier 1 is a pre-requisite to Tier 2 and Tier 2 is a pre-requisite for Tier 3. For students entering at Tier 2 or Tier 3, pre-requisite may include Computer Maintenance, or Electronics, or current Industry Experience. Tier 2 is a pre-requisite to Network Administration.

8. **REVISION DATE:** **July 18, 2000**

9. COURSE OUTLINE

a. CAREER PERFORMANCE STANDARDS

CAREER PERFORMANCE STANDARDS	EXPECTED STUDENT OUTCOMES	HOURS
Instruction will include :	**Student will be able to:**	
1. **Personal Skills** ✍ Classroom policies & procedures ✍ Ethics Work Business ✍ Sexual harassment laws ✍ Personal skills, including positive attitude, self-confident, honesty, perseverance & self-discipline ✍ Professional appearance ✍ Time management ✍ Lifelong learning	**1. Understand how personal skill development, including positive attitude, honesty, self-confidence, time management, & other positive traits affect employability.** ✍ Demonstrate and understand classroom policies & procedures ✍ Define work and business ethics & demonstrate the importance of ethical standards & social responsibilities in the business environment. ✍ Discuss the laws applicable to sexual harassment & discuss tactics for handling harassment situations. ✍ Demonstrate personal skills in class and/or business environment: Positive attitude Self-confidence Honesty Perseverance Self-discipline ✍ Demonstrate and model personal hygiene and acceptable professional attire ✍ Prioritize tasks and meet deadlines ✍ Explain the importance of lifelong learning	**Integrated in content area skills** **All Sections**

CAREER PERFORMANCE STANDARDS	EXPECTED STUDENT OUTCOMES	HOURS
Instruction will include :	**Student will be able to:**	
2. **Interpersonal Skills** ✍ Group dynamics ✍ Conflict resolution and negotiation ✍ Team work ✍ Etiquette across gender and cultural groups	2. **Understand principles of effective interpersonal skills, including group dynamics, conflict resolution, and negotiation.** ✍ Identify and explain the key concepts of group dynamics ✍ Discuss and demonstrate the dynamics of conflict resolution and negotiation, and their importance within the business environment ✍ Demonstrate effective teamwork, share responsibilities, accept supervision and assume leadership roles ✍ Demonstrate cooperative working relationships and proper etiquette across gender and cultural groups	**Integrated in content area skills** **All Sections**
3. **Thinking and Problem-Solving Skills** ✍ Critical and creative thinking skills ✍ Logical reasoning and problem-solving skills ✍ Numerical estimation, measurement, and calculation ✍ Identify, locate, and organize needed information and propose, evaluate, and select alternative solutions	3. **Understand the importance of critical thinking and problem-solving skills in the workplace**. ✍ Apply critical and creative thinking skills in a work environment and implement a plan of improvement as needed ✍ Demonstrate logical reasoning and problem solving skills in a work environment ✍ Apply numerical estimation, measurement and calculation skills to business applications including the following: Whole number math Decimals & fractions Counting & monetary functions Use of tables & graphs ✍ Recognize problem situations; identify, locate and organize needed information, and propose, evaluate and select from alternate solutions	**Integrated in content area skills** **Sections: 5,6,11,13,17,18**

CAREER PERFORMANCE STANDARDS	EXPECTED STUDENT OUTCOMES	HOURS
Instruction will include :	**Student will be able to:**	
4. **Communication Skills** ✍ Written communications ✍ Verbal and Nonverbal communications ✍ Active and effective listening ✍ Proper etiquette in business communications ✍ Writing and editing skills ✍ Use of reference material and handbooks ✍ Oral presentations	4. **Understand principles of effective communication.** ✍ Read and implement written instructions, technical manuals, written communication, and reference books ✍ Present a positive image of verbal and nonverbal communication through use of appropriate methods ✍ Demonstrate active and effective listening skills through verbal, nonverbal and written feedback ✍ Demonstrate proper etiquette in business communications, including an awareness of requisite for international communications (languages, customs, and time zones) ✍ Demonstrate the following writing and editing skills: Use correct grammar, punctuation, capitalization, vocabulary and spelling Write, proofread and edit Select and use appropriate forms of communication ✍ Exhibit a proficiency in the use of reference materials such as dictionary, thesaurus, telephone directory, almanac, zip code directory, and office handbooks	**Integrated in content area skills** **All Sections**
5. **Occupational Safety** ✍ Good safety practices	5. **Understand occupational safety issues, including avoidance of physical hazards** ✍ Model and implement good safety practices including: Avoidance and reporting of physical hazards in the work environment Safe operation of equipment Proper handling of hazardous materials	**Integrated in content area skills** **All Sections**

CAREER PERFORMANCE STANDARDS	EXPECTED STUDENT OUTCOMES	HOURS
Instruction will include :	**Student will be able to:**	
6. **Employment Literacy** ✍ Expand awareness of career opportunities ✍ Set employment goals and objectives ✍ Aptitudes, personal characteristics and interests ✍ Develop portfolio to C-TAP standards ✍ Develop interviewing techniques	**6. Understand career paths and strategies for obtaining employment.** ✍ Explore career opportunities and develop a career plan ✍ Identify steps for setting goals and writing personal goals and objectives ✍ Examine aptitudes related to career options; relate personal characteristics and interests to educational and occupational opportunities ✍ Develop a portfolio to include the following: Letter of Introduction Cover letter Resume Thank you letter Job application Licenses, Certificates and Awards Transcripts Letters of Recommendation Work Samples	**Integrated in content area skills** **All Sections**
7. **Technology Literacy** ✍ Apply Industry specific technology ✍ Use Industry specific software ✍ Demonstrate Keyboarding ✍ Accessing information ✍ Lifelong enhancement of technology skills	7. **Understand and adapt to changing technology.** ✍ Identify and demonstrate use of appropriate technology ✍ Identify and use industry specific software ✍ Demonstrate proficiency in alphanumeric keyboarding ✍ Input and retrieve information ✍ Understand the importance of lifelong learning in adapting to changing technology	**Integrated in content area skills** **All Sections**

b. CONTENT AREA SKILLS

CONTENT AREA SKILLS	EXPECTED STUDENT OUTCOMES	HOURS CL = Classroom CC = Comm. Class. CP = Co-op Ed.		
Instruction will include :	**Student will be able to:**	**CL**	**CC**	**CP**
TIER 1: Introduction to Telecommunications: **1. The Physical Layer of Communications:** An interactive introduction to the basic systems and the Physical layer components present in the field of telecommunications.	a) Define Physical Layer b) Accurately identify 12 physical layer components represented on an interactive simulation system. c) Demonstrate how to trace signal flow. d) Demonstrate correct use of a **DA**ta **V**oice **E**lectric test device by showing continuity in a test cable. e) Demonstrate correct use of the student personal optical test device by showing continuity in a fiber optic cable.	12 hrs		
2. History of Telecommunications: An introduction to the history and the functions of the telecommunications systems for Telegraph, Telephone, Radio, Television, and Networked Computers.	a) Define telecommunications and the communication process. b) Understand and identify key developments in the history of telecommunications devices. c) Identify and understand the cable systems used for the distribution of data, voice and video. d) Demonstrate knowledge of the communication process by identifying a telecommunication system block diagram.	7 hrs		
3. Transmission Media Physical Layer Components: Students will be introduced to the characteristics of cabling systems and terminations which constitute the "Physical Layer" of the telecommunications field. Instruction will include construction characteristics, industry standard configurations, signal transmission capability, and the application of each cable system.	a) Define the level or category associated with twisted pair cable systems. b) Understand and explain noise reduction and cross talk terms and demonstrate one elimination technique. c) Understand and explain characteristics of a 2-pair and a 4-pair system cable. d) Identify and accurately define "Tip" and "Ring". e) Identify the characteristics of RJ-11 and RJ-45 associated plus, jacks, patch cords and adapters. f) Map a diagram of pair to pin configurations using EIA/TIA 570 Standard.	3 hrs		

	g) Identify the characteristics of coaxial cables BNC and F-Type Connectors. h) Identify characteristics of a Fiber Optic cable system and the ST Connector.			
4. **Safety:** An introduction to general safety procedures, electrical hazards, hazardous equipment and fire safety.	a) Identify 7 areas of personal safety requirements for protection. b) Define 3 key points concerning job site safety. c) Define 5 points of safety regarding electrical equipment. d) Understand the definition of MSDS procedures for working with hazardous materials. e) Identify 4 safety procedures and precautions regarding industry equipment. f) Identify and explain 3 procedures and precautions to be followed for fire prevention.	1 hrs		
5. Industry Tools, Cable construction techniques and Test equipment: An introduction to techniques used by line technicians to construct a cable system. Instruction will include performing a continuity test on a cable constructed by the student.	a) Demonstrate how to operate a coaxial cable stripping tool. b) Demonstrate how to operate an RJ-11 striping and crimping tool. c) Perform a safe and correct stripping and termination of a 2-pair telephone cable and construct it with RJ-11 connector. d) Perform a safe and correct stripping and termination of a coaxial cable and construct it with an F-Type connector. e) Perform a continuity check on a cable constructed by the student utilizing a DAVE test device.	4 hrs	4 hrs	
6. Testing and Troubleshooting the Physical Layer: An introduction to testing and troubleshooting techniques to identify and record faulty systems indications.	a) Understand and identify preventive maintenance measures by performing operational checks utilizing a DAVE test device with the interactive simulation system. b) Demonstrate knowledge of troubleshooting techniques by performing End-To-End signal tests utilizing a DAVE test device with the interactive simulation system. c) Demonstrate knowledge of testing techniques by performing a selective	6 hrs	6 hrs	

	test of an individual cable subsystem with the interactive simulation system. d) Demonstrate knowledge of signal testing by performing a test of a fiber optic system utilizing the Student Personal Optical Test device on a fiber cable and the interactive simulation system. e) Understand and identify 4 basic troubleshooting techniques. f) Demonstrate knowledge of patch cords, adapters and bridging clips by simulating correction of malfunctions on the interactive simulation system.			
7. **The future of Tele-communications:** An introduction to new technology developments of the Telecommunication Industry.	a) Define Smart House and identify 3 key components. b) Speculate future developments of Wireless Systems. c) Speculate future developments in Consumer Electronics.	2 hrs		
Complete Complete Tier 1 foundation: Introduction	a) Complete all Activities and Quizzes to receive verification of accomplishment.	2 hrs		
Tier 1 Complete				
TIER 2: The Physical Layer of Copper-Based Systems: 8. **Advanced Cable Training Units:** Introduction to the operation of the Advanced Cable Training unit, herein referred to as the **ACT Unit** and the Cable Transmitter/Receiver cable test unit, herein referred to as the "**DAVE**" Test Device.	a) Identify and correctly name all the components of the cable training unit. b) Identify and correctly name all the components of the transmitter/receiver cable testing unit. c) Correctly identify and correctly name each cable and adapter used.	6 hrs		
9. Twisted Pair Cable Systems: Configuration and application of various cables and termination of Twisted Pair, 8P8C Modular Plug and Jacks. Introduction to the configuration and applications of 66-Type and 110-Type Terminal Blocks.	a) Identify and describe Twisted Pair Cables. b) Demonstrate the correct construction of Twisted Pair Cables. c) Identify and describe the TIP and RING d) Identify and accurately demonstrate twist length e) Describe the physical configuration of voice and data transmission f) Identify the characteristics and	10 hrs	6 hrs	

	application of 4-Pair Unshielded Twisted Pair Cables g) Define category ratings h) Interpret and describe color code for pair and conductor configuration of Solid Color Wires and Striped Wires i) Identify and demonstrate the process to terminate twisted pair on modular patch cords, plugs and outlets. j) Describe the configuration and application of 8-position 8-conductor (8P8C) modular patch cords, plugs and outlets k) Demonstrate the construction of the pin configuration, and the mounting process. l) Describe the Category rating for 8P8C. m) Demonstrate the mounting process for 8P8C. n) Describe the configuration and application of T568B, T568A and USOC termination. o) Demonstrate color codes and termination process for T568A, T568B, and USOC connections. p) Identify the correct configuration and application of 66-type terminal blocks. q) Describe the category rating for 66-type. r) Correctly identify 66-type size. s) Correctly identify layout and color code for 66-type t) Identify the correct configuration and application for 110-type terminal block. u) Describe the category rating for 110-type. v) Correctly identify layout and color code for 110-type. w) Identify the correctly configuration and application of a modular patch panel. x) Describe the category rating for modular patch panel. y) Correctly identify layout and color code for 110-type. z) Identify characteristics and applications of shielded 4-pair cable. aa) Correctly define drain wire. bb) Correctly describe the construction of			

	shielded 4-pair cable. cc) Correctly identify shielded modular outlets. dd) Correctly identify and configure terminal blocks for shielded 4-pair cable.			
10. Safety Installation Techniques, and Tools Utilized in Copper Network Cabling: The characteristics and applications of the correct tools utilized in Network Cabling and installation techniques for tool usage. Safety precautions and procedures for on-the-job sites for personnel protection.	a) Demonstrate the operation of a 1-wire impact Punchdown tool. b) Identify blade configuration. c) Demonstrate the accurate use and application of the 10-wire impact tool. d) Demonstrate the accurate use and operation of the cable stripping tool. e) Demonstrate the accurate use and operation of the coax stripping tool. f) Demonstrate the accurate use and operation of the crimp tool. g) Accurately identify the 8P8C modular die. h) Accurately identify the coax die. i) Understand and explain safety procedures and precautions for protection of personnel. j) Understand and explain safety procedures and precautions to be followed at a work site. k) Understand procedures to procure work permits and lock-out procedures. l) Understand the safety procedures and precautions to follow for prevention of electrical hazards. m) Identify insulated tools required for specific purposes. n) Understand and explain Proximity and Hot Work. o) Understand and follow procedures and precautions taken for working with hand tools, power tools, ladders, scaffolds and prevention of injuries. p) Understand and follow procedures taken for necessary barricades. q) Understand and follow procedures and precautions for fire prevention, location and access to fire alarms and emergency exits at work sites. r) Understand and identify 2 classes of fire extinguishers and their correct use. s) Identify the minimum distance	6 hrs	6 hrs	

	requirements between cables and power sources of Transformers, electrical service entrances, high voltage wiring and fixtures and 110 volt wiring. t) Identify 4 types of cable supports. u) Describe and demonstrate the step-by-step process to pull cables, 25 pair, 4/5 UTP or ScTP, either from cartons, spools or reels. v) Describe the step-by-step process to install cable in buildings, vertical, riser, or horizontal. w) Demonstrate pulling cable through conduit. x) Explain the procedure to place cable in walls. y) Demonstrate a practical procedure to labeling a cable system.			
11. 4-Pair Cable Systems: The construction and termination of twisted pair cables utilizing the Advanced Cabling Trainer device unit and the DAVE test unit. Instruction will include cable pair color codes and layouts to understand pin configuration. Instruction will include a variety of techniques to diagnose and troubleshoot cables for shorts, opens, transposals, and reversals.	a) Identify and correctly explain the pair layout and pin assignment illustrated on the Advanced Cabling Trainer device. b) Correctly decipher the DAVE test unit Receiver. c) Demonstrate termination of unshielded twisted pair cable to an 8P8C plug 568B. d) Demonstrate termination of a shielded twisted pair cable to an 8P8C plug 568B. e) Demonstrate the accurate process to strip the outer jackets of cables. f) Accurately configure cables using correct color codes. g) Demonstrate the use of the 8P8C modular crimp tool to accurately install a modular plug. h) Demonstrate the correct usage of the DAVE test unit to test for continuity. i) Demonstrate the correct testing procedures using the Advanced Cabling Trainer Unit to test for Foreign voltage, Connectivity, Opens, Shorts, Reversals, Transposals, Transposals with Reversals; and Split Pairs. j) Demonstrate the ability to troubleshoot	24 hrs	6 hrs	

	Pair to Pin Configurations. k) Explain the DAVE Unit Receiver and Banner Board LED readouts for known and unknown configuration. l) Demonstrate termination and testing of 4-Pair Unshielded Twisted Pair cable to 66 and 110 connection blocks and modular jacks. m) Demonstrate proper procedure to strip Unshielded Twisted Pair cable. n) Demonstrate proper wire arrangement according to color code. o) Demonstrate how to route wire into blocks. p) Demonstrate proper usage of non-impact tool to punch down wire on blocks. q) Demonstrate troubleshooting a 4-Pair UTP 110 Block cable system connected to the Advanced Cable Trainer Unit for configuration and reversals. r) Demonstrate troubleshooting a 4-Pair UTP 66-Block cable system connected to the Advanced Cable Trainer Unit for configuration and reversals. s) Demonstrate correct termination of 4-Pair UTP cable on a modular jack. t) Demonstrate correct usage of non-impact tool to connect modular jacks u) Demonstrate troubleshooting a 4-Pair cable to modular jack on the ACT Unit utilizing the DAVE test unit for configuration and reversals.			
12. 2-Pair Shielded Twisted Pair Cable Systems: The construction and termination of twisted pair cables. Instruction will also include operation of the Advanced Cabling Trainer device unit and the DAVE test unit.	a) Demonstrate the proper construction of 2-Pair STP cable. b) Demonstrate proper color code configuration of 2-Pair STP cable. c) Identify and differentiate IBM 2-Pair STP type-1, type-2, type-6, type-8, type-9 cables. d) Demonstrate correct deciphering of a 4-Position Universal Data Connector with the DAVE Receiver device unit. e) Demonstrate correct termination of IBM 2-Pair cable with the 4-Position UDC. f) Demonstrate proper cutting and	8 hrs		

	trimming of cable. g) Demonstrate correct installation of strain relief collar and bushings. h) Demonstrate how to trim wire. i) Demonstrate correct claim installation. j) Demonstrate correct wire insertion according to proper color codes. k) Demonstrate ground installation. l) Demonstrate proper testing procedures for checking continuity for an IBM cabling system utilizing the ACT Unit and DAVE Unit. m) Demonstrate how to test for shorting bars. n) Demonstrate proper testing procedures for 2-Pair STP circuit utilizing the ACT and DAVE Units to troubleshoot for connectivity, shorts, opens, transposals, reversals, and reversals with transposals.			
13. Coaxial Cable Systems: The applications and termination of Coaxial cables utilizing the Advanced Cabling Trainer device unit and the DAVE test unit.	a) Identify and explain the characteristics of 3 types of coaxial cable and the applications of each. b) Demonstrate correct construction of coaxial cable. c) Identify and explain the characteristics of BNC, F-Type, and N-Type coaxial connectors and the applications of each. d) Identify and demonstrate the proper usage of coaxial cable Stripper and Crimper tools. e) Demonstrate correct termination of BNC connector to RG-59 coaxial cable. f) Demonstrate the Step strip process to specification. g) Demonstrate connecting pin and connector body. h) Demonstrate proper procedure to test BNC cable system utilizing the ACT Unit. i) Demonstrate correct termination of F-Connector to RG-59 cable utilizing the ACT and DAVE Units. j) Demonstrate proper crimping of connectors. k) Demonstrate how to test an F-Type	6 hrs	6 hrs	

	Connector utilizing the ACT and DAVE Units to test for connectivity.			
14. National Electric Code (N.E.C.): An introduction to the NEC codes which apply to premise wiring.	a) Orally site the correct NEC article number type and description of the codes Plenum, Riser, Commercial, and Residential. b) Interpret and explain cable substitution hierarchy. c) Understand 10 elements of the ANSI/TIA/EIA 568-A Standards. d) Explain the standards applicable to horizontal cabling. e) Describe Star Cable layout. f) Identify cable types used for horizontal and backbone layout. g) Understand and describe requirements for new cable installations. h) Understand and describe standards for backbone cabling. i) Describe a layout for Star, Bus, and Ring type networks. j) Identify connections for discontinuous cable. k) Describe the 568-A standard for building work areas, telecommunication closets, and equipment rooms. l) Describe the 568-A standard for UTP and ScTP cable termination and connecting hardware, color code, stripping cable jackets and labeling procedures.	4 hrs	4 hrs	
Complete Tier 2 Formal Examinations: Specialist certification is based upon a weighted average of 85%.	a) Pass a Written Examination, Cable Construction Examination, and Diagnostics Examination to receive a Certificate "Certified Cable Specialist – Copper" awarded by C-Tech according to requirements.	2 hrs		
Tier 2 Complete				
TIER 3: The Physical Layer of Fiber Optic Based Systems: **15. Fiber Optic Termination Training Unit:** An introduction to	a) Identify and describe proper use of the termination tray, canned air, eye loupe, safety eyewear, microscope, ST adapter, micro-clips, crimp tool, glass	1.5 hrs		

the tools and equipment of the Fiber Optic termination kit.	polishing plate, measuring ruler, scribe device, cleaning brush, scissors, and polishing discs. b) Identify and demonstrate safe use and containment of the chemical alcohol. c) Identify and demonstrate ST receptacle unit. a) Identify and demonstrate safe use of a fiber optic disposal unit. b) Demonstrate and describe proper disposal procedure of hazardous fiber waste material. c) Demonstrate and describe battery installation and safe operation of the heat strip tool and buffer tube stripper to produce a 1-inch exposure of fiber optic thread. d) Identify and demonstrate the SPOT fiber optic cable test device. e) Demonstrate battery installation and assembly of the fiber optic microscope for observation of fiber optic cables.			
16. Fiber Optic Concepts: An introduction to the concepts and terminology of Fiber Optic Systems.	a) Define a basic Fiber Optic System b) State 5 elements of a Fiber Optic system and the function of each. c) State the characteristics of LASERs and LEDs as used in transmission systems. d) Define the characteristics of light as it relates to Wavelength and frequency. e) Discuss 2 advantages and disadvantages of a Fiber Optic System. f) Define Reflection and Refraction. g) Define cable construction and it effect on the propagation of light. h) Define Signal Loss, mechanical attenuation and fiber attenuation.	2.5 hrs		
17. Fiber Optic System Components, Construction and Termination: An introduction to the functions of the components used in fiber optic cables and the intricate construction of loose core and tight core fiber optic cables with connectors.	a) Identify and describe the construction and characteristics of Loose Tube Design fiber cable. b) Identify and describe the construction of Loose Fiber Bundle Design. c) Identify the construction and characteristics of Slotted Core Design. d) Identify and describe the construction and characteristics of Ribbon Design.	23 hrs	6 hrs	

	e) Identify the construction and characteristics of Tight Construction fiber cable. f) Demonstrate the ability to compare cable characteristics of Bend radius, Tensile Strength, Impact Resistance, Crush Resistance, and Loss Sensitivity for loose and tight construction. g) Identify and describe the attributes of fusion splicing and mechanical splicing. h) Identify the construction and characteristics of 3 commonly used splice tools. i) Identify the function of a fiber optic closure. j) Identify the function and application of fiber optic cabinets, panels, and outlets. k) Accurately define connectorized. l) Accurately identify six commonly used fiber connector types. m) Demonstrate the use and application of a fiber optic coupler. n) Identify the parts and explain the function of a duplex arrangement coupler system. o) Demonstrate techniques learned by using correct polishing pads at proper intervals to produce a successfully clear fiber endface for termination. p) Demonstrate how to accurately terminate 3 types of fiber optic cables q) Demonstrate knowledge of continuity testing by performing a visual light continuity test utilizing the Student Personal Optical Test device. r) Demonstrate knowledge of Power and Loss measurements by performing a test to measure attenuation utilizing Attenuation testing devices.			
18. Placing Fiber Optic Cables: The step-by-step procedure for placing fiber optic cables in a building.	a) Demonstrate the ten-step sequence for placing a fiber optic cable in a building. b) Demonstrate the process of a vertical pull installation. c) Demonstrate the process of an open pathway horizontal pull installation.	4 hrs		

	d) Demonstrate a complete installation through a conduit. e) Identify one method of attaching a cable strength yarn to a pulling string. f) Demonstrate the process of cable preparation for installation. g) Demonstrate the process of attaching the cable string. h) Demonstrate the process of attaching a mesh grip and swivel. i) Accurately describe pulling string and cable. j) Describe mounting cabinets, shelves, and outlets. k) Demonstrate appropriate labeling of cable. l) Describe how to replace fire-blocking materials. m) Demonstrate safety precautions and procedures followed when placing fiber optic cable. n) Understand safety markings and warnings. o) Understand appropriate and complete communication with co-workers during installation. p) Demonstrate proper tool selection and operation. q) Demonstrate knowledge of appropriate use of safety glasses and termination tray.			
Complete Tier 3 Formal Examinations: Specialist certification is based upon a weighted average of 85%.	a) Pass a Written Examination, Cable Construction Examination, and Diagnostics Examination to receive a Certificate "Certified Cable Specialist – Copper" awarded by C-Tech according to requirements.	2 hrs		
		TOTAL HOURS: 136 hrs	44 hrs	

10. ADDITIONAL RECOMMENDED /OPTIONAL ITEMS

a. ARTICULATION: **Hartnell College Computer Information Systems II**

b. VOCATIONAL CREDIT: **10 Credits**

c. ACADEMIC CREDIT: **None at this time**

d. INSTRUCTIONAL STRATEGIES: **Guided Team and Independent Work**
Actual Cable construction, troubleshooting, Community Classroom, Guest Speakers
Field Trips to Electronics Suppliers, Cable Communications

e. INSTRUCTIONAL MATERIALS: **Workbook: (C-Tech) Introduction to Networking, Copper and Fiber Optics**

f. CERTIFICATES: Industry Certification in cooperation with C-Tech for earned weighted grade of 85% or better.
Certificate of Completion = Classroom instruction "C" or better
Certificate of Accomplishment = Classroom Instruction "C" or better
Certificate of Attendance = Attendance is 98% or better